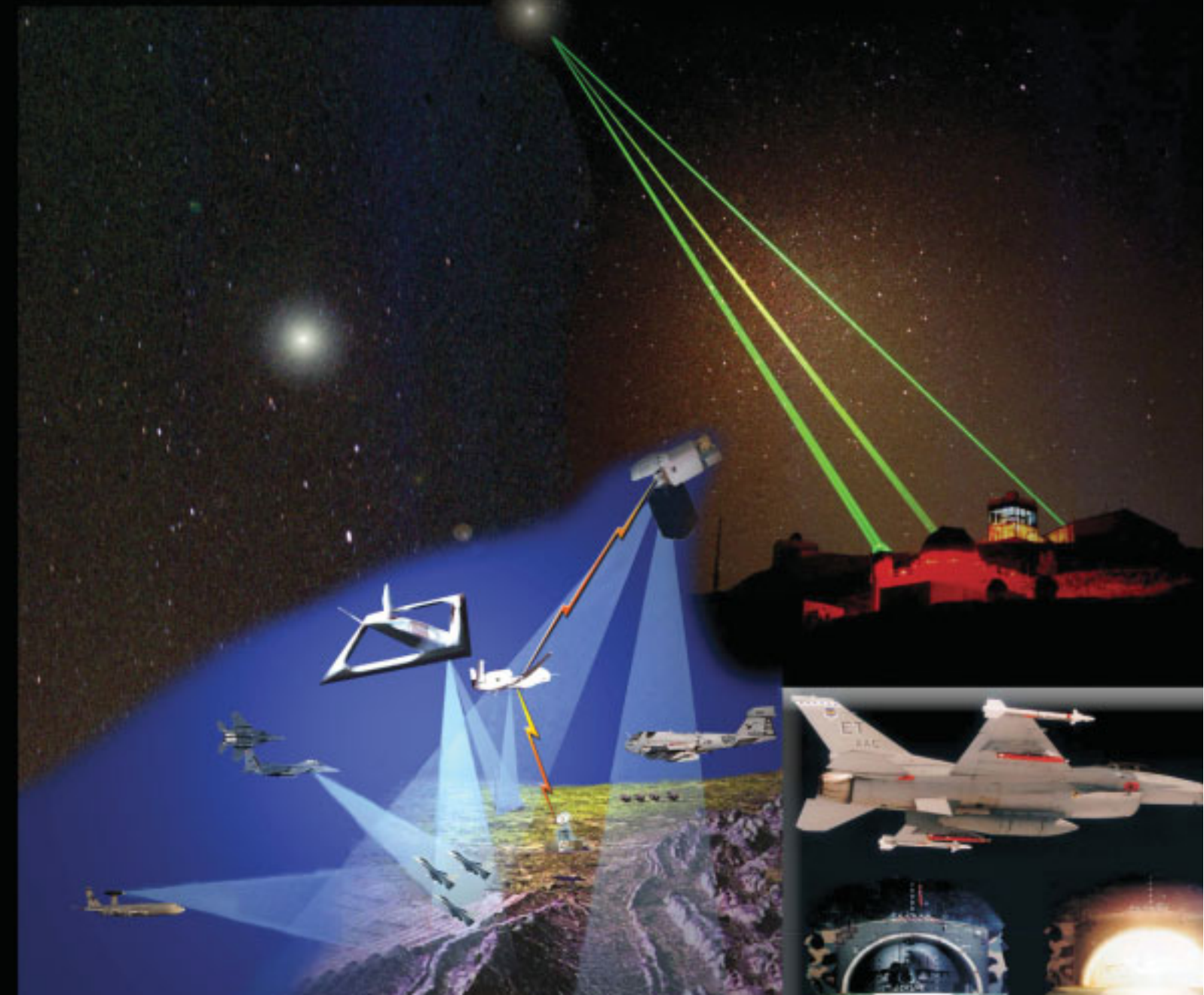


AIR FORCE MATERIEL COMMAND
**LEADING
EDGE**



Delivering the future





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Cover stories

4 - 18 Delivering the future

Solving today's problems and creating tomorrow's air and space force, AFMC develops and transitions cutting-edge technologies for the warfighters. Turn the page to read how we integrate technologies to provide improved warfighting capabilities that are higher performing, more sustainable and cheaper to buy and operate.



Cover illustration by Ms. Donna McBroom, AFRL/XPTC.

Mission Progress

- 19 'Flying' made easy
- 20 Coming together for the F-22

Features

- 21 It's a dog's life
- 22 Taking it to the field...

Departments Briefs

- 3 Mission Briefs
- 18 News Briefs
- 24 People
- 26 Awards



Having paid his dues by successfully participating in drug busts and Oklahoma City bombing recovery efforts, Remco retires to a life of leisure. Read about it on page 21.



Supersonic separation

EDWARDS AIR FORCE BASE, Calif. — F-22 Test Pilot Lt. Col. Chris Short of the F-22 Combined Test Force here fired an AIM-9 sidewinder missile from Raptor 4003 during a test mission originating from Edwards July 25.

The AIM-9 is a supersonic, heat-seeking, air-to-air missile carried by fighter aircraft. The flight test marked the F-22 program's first supersonic missile separation.

— Reported by AFFTC Public Affairs
(Photo by Tom Reynolds, AFFTC)

Hill, DLA, Goodrich partner improving parts availability

HILL AIR FORCE BASE, Utah — Ogden Air Logistics Center, Goodrich Corporation and Defense Logistics Agency officials recently entered a long-term partnership to provide aircraft parts quicker and save the Air Force millions of dollars in the next decade.

Officials representing the three parties signed a strategic sourcing initiative memorandum of agreement which covers landing gear, wheel and brake spare parts to make the partnership official.

The partnership reduces many administrative matters involved in getting parts, and each party's comfort zone will be expanded by knowing business is running both ways. Hill experts know they're going to get the parts when they need them, and Goodrich officials know a forecasted amount of parts will be purchased.

In addition, the three parties could benefit with potential landing gear engineer-

ing and overhaul work coming down the pike via new aircraft like the C-17 Globemaster, F-22 Raptor and Joint Strike Fighter.

— Reported by OO-ALC Public Affairs

Rolls-Royce Adour engine reaches major milestone

ARNOLD AIR FORCE BASE, TENN. — An interim standard Rolls-Royce Turbomeca Adour engine reached the preliminary flight certification milestone following 150 engine operating hours of testing here.

This was the first time the engine has been tested here.

The engine operated at simulated flight conditions from sea level to 45,000 feet at high speeds to establish engine performance and handling. The engine is an upgrade of the Adour, a mid-size, dual spool, low bypass turbofan engine with a non-afterburning fixed area nozzle.

Previous versions of this engine are used primarily in the BAE Systems Hawk and the U.S. Navy Boeing T-54 Goshawk trainer aircraft.

— Reported by AEDC Public Affairs

Simulator means less flying for AWACS crews

TINKER AIR FORCE BASE, Okla. — Airborne Warning and Control System crews may get to spend more time with their feet planted firmly on the ground now that the Air Force's newest E-3 flight simulators are up and running.

The simulators which can replicate weather conditions, wind turbulence and even generate smoke in the cockpit — have been tested by a certification team from Eglin AFB, Fla., and are awaiting final approval.

A four-person team recently deployed to Tinker for 10 days of riding out artificial storms, tugging on toggles and pulling on switches.

If everything checks out, AWACS aircrews will soon be able to receive some flight certifications without ever boarding an actual jet.

Simulators will never fully replace actual flight training, but they can take the

place of much of it — saving maintenance and fuel costs.

— Reported by OC-ALC Public Affairs

F-111 test provides data for new fleet of military aircraft

ARNOLD AIR FORCE BASE, Tenn. — A test at Arnold Engineering Development Center here will help reduce risk for future weapon integration of new small munitions on the next generation of combat aircraft.

The center tested a 1/15-scale model of the low cost autonomous attack system, or LOCAAS, mounted to a sting. A sting positions the LOCAAS to simulate separation from the F-111 aircraft during wind tunnel testing in the center's four-foot transonic wind tunnel.

During the test, engineers examined the release of small munitions from the aircraft with supersonic capability and with internal weapon bays.

The data will be used to reduce risk for future weapon integration of small munitions for aircraft including the F-22 Raptor, the F-35 Joint Strike Fighter and the Unmanned Combat Air Vehicle.

— Reported by AEDC Public Affairs

New facility paves way for ABL ground testing

EDWARDS AIR FORCE BASE, Calif. — With the Airborne Laser flight test program underway, members of the ABL Integrated Test Force here are putting the finishing touches on a new facility that will be key to upcoming ground tests.

The ground pressure recovery assembly is nearing completion with only minor wiring and fabrication work left to be done. The \$18.5 million test support structure will allow the test team to operate the weapons class, chemical laser and conduct testing on the ground.

The laser, which will sit aboard a modified 747-400 series freighter aircraft, is designed to shoot down ballistic missiles while they are still over an enemy's own territory.

— Reported by AFFTC Public Affairs

AFRL provides innovative solutions for warfighters

— Maj. Gen. Paul Nielsen
Air Force Research Laboratory Commander

As one of the world's premier research laboratories, we at Air Force Research Laboratory are committed to our vision — We defend America by unleashing the power of innovative air and space technology. Since the Air Force's science and technology efforts were consolidated in 1997, AFRL's scientists and engineers have been solving today's problems and creating tomorrow's air and space force.

The tragic events of September 11, 2001, will forever change our world. As Americans, we now contemplate and cherish the freedoms we enjoy. Additionally, as members of the U.S. Air Force, we are called upon to protect our great nation.

During this past year, the need for quick, cost-effective acquisition and transition of new technology has become increasingly critical. We need to develop and transition cutting-edge technologies in record time, so that we can win the war on terror.

This war requires new tools and processes — intelligence systems, sensors, analytical tools, and offensive and defensive systems. AFRL continues to pursue advanced technologies in such diverse areas as air vehicles and satellites; aero, rocket and space propulsion; conventional munitions and directed energy; sensors and information; exotic materials; and training and protecting the Air Force's most important resource — its people.

We work with the other centers in AFMC and with the Air Force Space Command to integrate our technologies to provide improved warfighting capabilities that are higher performing, more sustainable, and cheaper to buy and operate. This mindset focuses on our mission: Leading the discovery, development and integration of affordable warfighting technologies for our Air and Space Force.

Turning science fiction into science fact

Every day, AFRL strives to break technology barriers in its quest to assure that the Air Force maintains its indisputable worldwide pre-eminence. Investment in science and technology will always be vital to this quest.

AFRL's interests span the spectrum of science, often beyond the

Top: Distributed mission training network testing at the Mesa Research Site, Ariz. Middle: Fabrication shop personnel mill a special component for rocket propulsion research at the Edwards Research Site. Bottom: Firefighters take a breather following an evaluation of the combined agent firefighting system at Tyndall AFB, Fla. (AFRL photos)

air and space arena. As a laboratory, AFRL has much to offer the Air Force, the other services and federal agencies, as well as the private sector and academia.

Over the past year, the work of AFRL's men and women has resulted in many accomplishments, on a variety of levels. From our daily research and experimentation, such as Dr. Lene Hau's freezing of light, to the actual performance of defense systems, such as the first flight of the Airborne Laser and the Unmanned Combat Air Vehicle, AFRL consistently stands on the cutting edge of science and technology.

Would you believe we froze light?

Light stood still recently, for Dr. Hau, a Gordon McKay Professor of Applied Physics and professor of physics at Harvard University.

Albert Einstein theorized that a signal light cannot travel faster than 186,282 miles per second, but Dr. Hau harnessed the notion of light going slower, and even completely stopping. Dr. Hau froze it in place for up to several thousandths of a second.

This accomplishment may lead to an array of spectacular advances in science and technology. A new generation of computers, which could solve problems inaccessible to today's computers, could potentially be developed. Practical Air Force applications include new ways to communicate solely by light and through coding methods, to protect military and personal information, and to control optical information storage.

Dr. Hau is one of many scientists whose research is sponsored by AFRL's Air Force Office of Scientific Research.

Who's driving this thing?

On May 22, the X-45A Unmanned Combat Air Vehicle took to the skies for its first flight. This major advance in aerospace technology occurred as the result of a Defense Advanced Research Projects Agency, AFRL and Boeing collaboration. The 14-minute flight marked the first step in transforming combat capability for the Air Force of the early 21st century.

The X-45A flew at NASA's Dryden Flight Research Center on Edwards Air Force Base, Calif., where the aircraft reached an airspeed of 195 knots and an altitude of 7,500 feet.

Later this year, the team will fly a second X-45A, the red bird, which will lead to multi-aircraft flight-test demonstrations next year. Eventually, UCAVs will fly in packs, seeking enemy anti-aircraft missile launchers, and work together to destroy

them, with a human operator who could be located anywhere in the world. The next stage in development is the X-45B, a larger and more capable version than the X-45A.

Beaming about our Airborne Laser

The Airborne Laser — an extensively modified Boeing 747-400F destined to be the world's first directed energy combat aircraft — made its 82-minute maiden flight over western Kansas July 18.

This maiden flight represented a major step forward toward knocking an airborne ballistic missile to the ground with a beam of ultra-powerful light by the end of 2004.

Following the demonstration in 2004, ABL, officially named YAL-1A, will take its place as a principal member of the boost phase segment of the Missile Defense Agency's layered system designed to protect the country against ballistic missiles.

The recently painted aircraft is undergoing airworthiness evaluations and will then be flown to Edwards AFB, where the other weapon system segments — the lasers and the optical system — will be incrementally installed and tested.

That process is expected to take almost two years and includes laser firings on the ground and against a number of objects in the air, such as balloon-dropped target boards and short-range rockets, in preparation for its major test against a ballistic missile.

Polybenzobisoxazole?

Polybenzobisoxazole, or PBO, is known commercially as Zylon, and is now used in a wide variety of commercial products, including tires, belts, hoses, plastics, concrete, gaskets, ballistic flak vests, cut and abrasion resistant safety gloves and protective clothing for firefighters.

Additionally, the material developed by AFRL's Materials and Manufacturing Directorate researchers, is also used to keep race-car tires and wheel assemblies attached to racecars when they crash.

Known as the safety wheel energy management system, tethers made from PBO are used in such major racing events as the Indianapolis 500.

AFRL continues to provide tremendous support to the warfighter. The exciting technological advances happening with-

AFRL continued on page 6

AFRL continued from previous page

in the lab span the spectrum of our directorates.

The Materials and Manufacturing Directorate is researching blast mitigation to protect personnel from attack. The project involves retrofitting structures with a polymer coating to absorb blast energy while containing shattered wall fragments. This technology is also being considered for use at the Pentagon.

Another Materials and Manufacturing development, the all purpose remote transport system, employs advanced robotic technologies and unmanned ground systems to protect, support and augment the warfighter. Systems can serve in several modes to include clearing unexploded ordnance, and detecting, analyzing and rendering safe improvised explosive devices. This technology has been used in Operation Enduring Freedom.

Who's the BOSS?

AFRL's Directed Energy Directorate is developing a Battlefield Optical Surveillance System, or BOSS, a mobile, self-contained platform that uses lasers, optics and sensors for surveillance, optical augmentation and illumination of targets. Initially envisioned as a mobile counter sniper platform, BOSS has evolved into a working concept of a surveillance and detection system with the ability to designate a battlefield threat.

The directorate's Laser Division also developed the Saber 203 Laser Illuminator. This technology illuminates an opponent with harmless, low-power laser light, temporarily impairing an adversary's ability to effectively aim a weapon.

Developed by Directed Energy and the Defense Department's Joint Non-lethal Weapons Directorate, active denial technology is a breakthrough, non-lethal technology that uses millimeter-wave electromagnetic energy to stop, deter and turn back an advancing adversary from relatively long range. It is expected to save countless lives.

Information in formation

The Information Directorate's Interactive Data Wall is a multimedia data display and control unit that provides warfighters with high-resolution, near real-time situational awareness of a battlespace. The 12-foot by 3-foot screen provides users with a multitude of data such as detailed terrain, land route maps, real-time audio and video communications, airborne surveillance and intelligence information, and archived geographic database information.

The Information Directorate is also working on organizational predictive modeling. This program produces an algorithm that models and learns about asymmetric threats. The prototype system predicted behavior of a terrorist organization over a four-year period. The technology integrates planning, psychosocial modeling and simulation, and risk analysis to create behavior models.

Truly smart munitions

The Munitions Directorate supported Air Combat Command warfighters by quickly retrofitting an MK-20 (Rockeye) from Eglin AFB, Fla., which is now used to drop informational leaflets over Afghanistan. The MK-20 replaced the M129 leaflet

bomb used during WWII.

The directorate's deployed bomb damage assessment project at Eglin incorporates a video camera sensor, deployed from and towed behind falling munitions with a tether, to get real-time weapons assessments. It transmits video of the weapon's impact and target detonation, increasing air power for the warfighter and saving pilot's lives by avoiding the need to restrike the target.

Seeing infraRED

Space Vehicles Directorate is developing the infrared technology center of excellence. Researchers at Kirtland AFB, N.M., and Hanscom AFB, Mass., are investigating light polarization phenomena, polarimetry remote sensing, as a potential new tool for the warfighter.

The remote sensing and surveillance research works on the concept that polarized light within a scene can be analyzed to detect otherwise unseen targets, find man-made objects within a cluttered background, or augment and cue other sensors.

A new twist on 'wings'

The Air Vehicles Directorate is developing on-vehicle control capabilities to enable UAVs to be as safe and effective as manned assets, but at significantly reduced size, weight and cost. Technologies in development include photonic vehicle management systems, intelligent reconfigurable control, prognostic health management, and automatic air collision avoidance.

Today's high speed aircraft wings aeroelastically warp or twist at very high speeds. The directorate, in cooperation with NASA Dryden and Boeing Phantom Works, is researching a "wing warping" approach to control this warp or twist. The program is called active aeroelastic wing flight research program using an F-18 aircraft as a test bed.

The focus of research is on developing and transitioning the application of aeroelastic wing concepts to replace traditional aircraft control surfaces such as ailerons and leading edge flaps. Roll maneuvering at high speeds will be improved by controlling the warp of the aircraft's wings. Additionally, this data will be used for transonic and supersonic aircraft.

Currently under development, Air Vehicle's automated aerial refueling program will provide aerial refueling capabilities to the Air Force's unmanned air vehicles including the UCAV. This will greatly enhance the effectiveness of these UAV's by increasing their range. Also, the technology will greatly reduce the workload in future manned fighters.

Sensing a major breakthrough

The Sensors Directorate is developing a photonic analog-to-digital conversion, or ADC, using light absorbers. Analog-to-digital converters are usually built using microelectronics and are adequate for many applications, but are limited for high speed, high resolution applications.

Optical sampling has the potential for significant improvement in ADC performance. The photonic ADC being investigated uses a parallel architecture and high-speed optical compo-

nents to provide a high-bandwidth, high resolution capability.

Eye-opening technology

The Human Effectiveness Directorate has been working with industry partners since the mid-90's to develop new, novel, ultrahigh-resolution visual display technologies. One of the major technology challenges to implement the concept of distributed mission training for pilots is to provide high-fidelity simulation of out-the-window visual scenes.

The field-of-view, brightness and contrast of practically every visual display system available today is far less than what a pilot sees outside an aircraft. Current visual displays display systems do not provide a pilot with adequate visual definition to identify other aircraft, ground vehicles, roads and bridges at realistic ranges or to properly assess angles of other aircraft. These limitations affect the ability to train pilots as they will fight.

Powering the future

Powering those UAV's and fighters into the skies, as well as missiles, launch vehicles and satellites, are systems designed and developed by the Propulsion Directorate.

Their advanced propulsion technologies aren't just science fiction concepts. Component testing of a hypersonic engine that can power cruise missiles at speeds up to eight times the speed of sound have been successfully completed and promise increased warfighter capabilities to give us the edge on future battlefields. Weapons like this could fly hundreds of miles in minutes to defeat time-critical targets.

Revolutionary advances in turbine engines lead by the directorate are also opening the future to lighter, faster and more efficient engines that will double the durability at a 10th of the cost. These advances aren't limited to the earth's atmosphere. Work is well underway developing electric, solar, laser and plasma propulsion systems for mini and micro satellites of the future.

Making dreams reality

Whether dealing with the war on terrorism, ballistic missile defense, or protecting fans at a racetrack, AFRL's vast array of capabilities proves valuable in any circumstance. The laboratory stands poised to lead our nation's military through the next century, as the world's best researchers make tomorrow's dreams a reality today.

Top: A 5-gallon high-shear mixer at the High Explosives Research and Development facility, Eglin AFB, Fla., is being inspected. Bottom: Although this space mirror resembles a giant contact lens, this experimental, inflatable membrane may pave the way for future, inexpensive technologies that enable the creation of large, lightweight structures in space.





A Joint Air-to-Surface Standoff Missile is dropped from an F-16 Fighting Falcon. An Air Force Manufacturing Technology Division improvement in the missile's manufacturing process will save more than \$19 million over the production life of the joint Air Force-Navy weapon system. (Air Force photo)

JASSM composite body program saves millions

A manufacturing process improvement for the body of the Joint Air-to-Surface Standoff Missile will save more than \$19 million over production life of the missile, according to officials at the Manufacturing Technology Division of the Air Force Research Laboratory's Materials and Manufacturing Directorate at Wright-Patterson Air Force Base, Ohio.

The directorate manages the cooperative effort, officially called the JASSM composite body rapid response process improvement program, which includes representatives of Lockheed Martin Corporation and Fiber Innovations, Inc.

A joint program

JASSM is a joint Air Force-Navy program developed and produced by Lockheed-Martin Integrated Systems. It employs stealth to penetrate enemy air defenses at ranges of more than 200 miles, and can be launched off most types of aircraft in the Air Force inventory. JASSM is designed to destroy high-value, well-defended, fixed and moving targets.

Most of the surface area and load bearing structure of each JASSM is manufactured using a braided composite process to place fibers in their proper orientation and shape. The majority of these parts are then molded using the vacuum-assisted resin transfer molding, or VaRTM, process.

In the past, a costly, hands-on trimming procedure was necessary after the VaRTM process. This led to ManTech approving a

plan for Lockheed-Martin to develop the JASSM composite missile body R2PI program.

By eliminating the post-VaRTM trimming steps, R2PI reduced the manufacturing risk to cost and schedule goals for JASSM by improving the manufacturing process.

It also developed net-shaped pre-forms for fuselage components, and improved the net edge molding of the upper and lower composite fuselage by refining the inner mold line dimensional control. It also optimized the resin infusion through automated temperature and pressure controls.

High level approval

Making JASSM more affordable has garnered high praise from the Defense Department and Air Force leaders. "JASSM is a flagship program for acquisition excellence," said Secretary of the Air Force Dr. James Roche.

"Not only do our combat forces get an unprecedented precision attack capability, but they get it at an affordable price never before achieved on a cruise missile program," he continued.

Undersecretary of Defense Pete Aldridge gave the JASSM program the go-ahead for low-rate initial production on Dec. 21, 2001. The Air Force plans to make the decision for full-rate production in late 2003.

— Mr. Gary Cunningham, AFRL Public Affairs

Tinker delivers precision munitions to warfighters

Soon after the terrorist attacks on Sept. 11, the Air Staff at the Pentagon directed the Cruise Missile Product Group at Tinker Air Force Base, Okla., to accelerate testing and production of a new precision missile designed to penetrate buildings or bunkers, and they delivered.

Mr. Joe Peach, program manager for the conventional air launched cruise missile, said production and testing of the AGM-86D was accelerated by about four to six months. "We got the phone call that afternoon and about a week later, we received direction by letter to accelerate the program in order to get the mis-

sile in inventory as quickly as possible," he said.

He said the group has deliv-

system guidance and a modified terminal area flight profile to maximize the effectiveness

"We have the only stand-off weapon in the Department of Defense inventory. The advantage you have with that is you don't put an aircraft or the aircrew at risk — you launch them outside theater defenses."

Mr. Joe Peach, AGM-86D program manager

ered dozens of AGM-86Ds to the warfighter supporting the war on terrorism.

The AGM-86D Block II program is the precision strike, penetrator variant of CALCM. It contains an advanced unitary penetrator warhead, global positioning

of the warhead. Launched from a B-52 bomber, the missile can strike accurately with little collateral damage to civilian sites.

"Specifically, this missile is designed to hold at-risk, high-value, deeply buried targets," he said. The missile could be

used in the mountains of Afghanistan to destroy tunnels, and its capability to penetrate is somewhat contingent on the surface that it penetrates.

"For example, if the mountain were granite instead of just rocks and dirt, the 86D would experience reduced penetration," he said. "Details like this are taken into consideration based on intelligence data."

The key, he said, is how close the missile can get to its target — a specific area of a bunker or building.

"Precision strike is what this is," Mr. Peach said.

— Mr. Ray Dozier, OC-ALC Public Affairs





The Air Force Research Laboratory Combined Agent Fire Fighting System in action recently at Tyndall AFB, Fla.

Fighting fire with fire

Air Force Research Laboratory personnel are starting fires and setting explosions — all in the name of providing innovative fire fighting technologies to the field.

Three, two, one, Fire! The countdown can be heard frequently on the test range at Tyndall Air Force Base, Fla., where evaluating raging fires and explosions is all in a day's work for a group of engineers, scientists and technicians whose mission is to find solutions to the needs of the wartime firefighter.

Air Force Research Laboratory's Fire Research Group conducts fire research and development associated with aircraft and building fires, agent development, advanced fire detection and suppression, improved vehicle performance and individual firefighter capabilities.

Developing new systems

These days, with the Air Force's transition to an expeditionary force and the current world situation driving new demands for fire fighting technology, they are busier than ever. "Our goal," said Mr. Virgil Carr, team leader, "is to develop or identify improved suppression and mitigation agents and the specialized equipment and

technologies required to counter new and evolving fire threats." This is no small task as developing weapons technology continues to increase in complexity, lethality and cost.

Currently, efforts are underway to develop a fire fighting apparatus that is light and air transportable, and more efficient than existing vehicles. The result is the combined agent fire fighting system. This system is a lightweight, skid mounted, dual-agent system for fighting hydrocarbon fuel fires. Easily transported, it delivers the same knockdown capability as a large crash rescue vehicle, but with significantly less weight, volume and cost.

"The secret to the effectiveness of the system is the use of dual-agent turret and handline nozzles that control and extinguish both pool and three-dimensional running fuel fires," said Ms. Jennifer Kalberer, fire protection engineer. The nozzle configuration allows the foam to triple the throw range of the dry chemical,

enabling it to provide exceptional knockdown and allowing the foam to quickly seal the surface area for complete extinguishment in a fraction of the time.

Field evaluations of the system are underway, and other potential applications include tent city fire protection, hot pit refueling, chemical and biological decontamination. Eventually, the system will be demonstrated for remote robotic operation.

Improving aircraft safety

Another of the group's projects involves improving aircraft cargo container safety aboard military and civil aircraft, which is essential for safely transporting hazardous materials. Testing flame-resistant materials, installing fire suppression systems and constructing a new generation of cargo container are all part of the group's effort to find a solution to a potentially disastrous problem.

In addition, AFRL is being funded by the Defense Ammunition Logistics

Agency to develop an Advanced Fire Protection Deluge System designed to save lives at munitions production plants. This system controls intense, rapidly burning fires occurring in munitions manufacturing accidents using an ultra-high speed detection and water suppression to detect and suppress a fire within 30 thousandths of a second, discharging cooling water at 180 feet per second, extinguishing the fire and leaving 98 percent of the munitions unburned while preventing human injury.

Also under development is an explosively driven extinguishing system to protect large areas of munitions mixing operations and manufacturing. More than twice as fast as the one currently being used, it represents a quantum leap forward in protection of munitions facilities.

A group effort

Another recent innovation involved retrofitting some older generation fire trucks with an improved suspension system decreasing the rollover potential. Working closely with industry leaders, personnel designed, fabricated, installed and tested a compact, inexpensive suspension strut to augment current leaf spring suspension systems. This technical approach has proved successful and may be specified for installation on some new commercially available fire trucks. Group personnel also perform fire fighting agent evaluations.

Recently, the Environmental Protection Agency identified the key ingredient in one of the Defense Department's most commonly used fire fighting agents — aqueous film forming foam — as having a detrimental impact on the environment. The group's future efforts include a search for an extinguishing agent that is free of persistent, bioaccumulating and toxic chemicals, while maintaining the military specification for fire fighting performance.

The ability to meet mission needs with a full array of unique fire research facilities and flexibility to meet customers' needs enables AFRL to keep the Defense Department in the lead of national and international aircraft crash and rescue fire research.

— Ms. Jennifer Spanich, AFRL Fire Research Group



The Air Force Research Laboratory fire group investigates a special project in the environmentally controlled fire hangar at Tyndall AFB, Fla.



F-117 test team delivers at JEF Experiment 2002

The F-117 Combined Test Force at Air Force Plant 42 in Palmdale, Calif., teamed up with its operational counterparts to wow participants and senior leaders at the Joint Expeditionary Force Experiment 2002. During the large-scale experiment held recently at Nellis Air Force Base, Nev., the test team unleashed a new time-critical targeting capability that is expanding what the stealth fighter brings to a combat environment.

Experimenting with change

JEFX02 is the fourth in a series of large-scale experiments designed to help the Air Force prepare for challenges of the 21st century Expeditionary Aerospace Force operations. Combining live, virtual and simulated forces, the experiment modeled a future command and control system, and explored the advanced technologies to improve the Air Force's ability to take out time-sensitive targets.

Enter the stealth fighter's demonstration project, officially known as the Integrated Real-time Information Into the Cockpit/Real-time Information Out of the Cockpit for Combat Aircraft flight-test project, or IRRCA. The project is providing

F-117 and its pilots with the ability to receive and transmit mission and target data in real-time from the air.

The F-117 test pilots from the combined test force at Palmdale along with operational testers from Detachment 1 of Air Combat Command's 53rd Test and Evaluation Group at Holloman AFB, N.M., flew missions in both live-flight portions of the experiment, including the new Global Strike Task Force portion designed to pave the way for land and sea forces in future conflicts.

From inside the Combined Air Operations Center at Nellis, Tech. Sgt. Dawn Cotton, an avionics craftsman with the F-117 combined test force, was able to send text messages to stealth pilots in the air allowing them to attack a new target in a different location or to capture battle damage assessment imagery of time-sensitive targets. In turn, pilots sent imagery and mission reports in real-time back to Sgt. Cotton on the ground.

Enthusiastic response

According to Sgt. Cotton, once the imagery began coming in, the crowd inside operations quickly started growing. At one point she gave up her seat so Secretary of the Air Force Dr.

James Roche and Air Force Chief of Staff Gen. John Jumper could have a closer look. Sgt. Cotton said that both the Secretary and the Chief were impressed with the picture quality and timeliness of the data coming into the ground station.

"At first others participating in the experiment were a little wishy-washy about what the IRRCA system could do," Sgt. Cotton said. "But as soon as our data came up on the screen, everyone from Intel to the time critical target experts in the room became very excited with this new Air Force capability."

A picture perfect setting

Until IRRCA testing, the potential time-critical combat capabilities of the F-117 had not been explored and there was no way to re-task the fighter from the ground to take out time-sensitive targets. For Mr. Mike Seelos, the F-117 test force's IRRCA project manager, the experiment proved to be the perfect setting to demonstrate what the new capability brings to the fight.

"The F-117's mission is to take out heavily defended high-value targets, so it's important that the stealth fighter and its capabilities were a part of the experiment," Mr. Seelos said. "We are the ones who are helping to kick down the door and this new capability played a key role in making that happen during JEFX02."

This year, the experiment was part of Millennium Challenge, a Congressionally mandated joint experiment designed to simulate a realistic 2007 battlefield to assess the interoperability of new methods to plan, organize and fight.

Partnering for success

This project is an initiative of the Air Force Research Laboratory's Sensors Directorate at Wright-Patterson AFB, Ohio, which has provided funding and guidance for the project since it began in 1997. The F-117 CTF in Palmdale, which includes the 410th Flight Test Squadron and lead F-117 contractor Lockheed Martin, has been working with the operational test community to evaluate the IRRCA demonstration project.

With the success of the experiment behind it, the test team plans to further develop the IRRCA project and explore its compatibility with the Air Force's Link-16 satellite capabilities, said Mr. Seelos.

— Ms. Leigh Anne Bierstine, AFFTC Public Affairs

Tinker makes B-2 'stealthier'

A combination of stealth technology, long range, large payload and precise munitions makes the B-2 Bomber the world's most capable long-range bomber, according to officials in the B-2 System Program Office at Tinker Air Force Base, Okla.

And now, with the help of the Oklahoma City Air Logistics Center, the B-2 stealth is making increased use of radar-absorbing materials that play a major factor in its being undetected by enemy radar.

The low observable integrated product team for the B-2 program office has arranged for the development of the largest robotics aircraft finishing system in the aerospace industry, or RAFS. The system performs precision coating application and reduces labor time by 80 percent.

Mr. Brian Kilburn, B-2 low observable integrated product team deputy, said joint government and industry teams will use robots from FANUC, a world-wide manufacturer of automotive robotics. "We integrated four of them together and are choreographing applications of radar absorbing materials onto the B-2 in support of the alternate high frequency material low observable maintainability modification, a major stealth modification planned for the B-2," he said. "This modification will improve mission capable rates by more than 8 percent and reduce maintenance man-hours per flying hour by 50 percent, a significant cost savings to the program."

Radar-absorbing materials are polyurethane coatings whose electrical and magnetic properties have been altered to allow absorption of microwave energy at broadband frequencies, according to officials at R&F Products, a manufacturer of microwave absorbing products. The amount of reduced energy, which returns to an enemies radar, is directly proportional to the increase in stealth effectiveness.

"When applying magnetic radar absorbing material, it is critical to ensure the thickness and location of the coatings are controlled, so we transitioned from a manual application technique to a robotics system to ensure that we met tolerances and achieved the added benefit of reducing labor costs," said Mr. Kilburn.

"We have installed RAFS in the depot maintenance facilities at Air Force Plant 42 in Palmdale, Calif., and are validating the robot's performance on a full sized mock-up of the B-2. The first application on an operational jet will be this fall."

CTA Inc., a robotics integrator, in conjunction with Northrup Grumman Corp., developed software that drives the robots, disperses and monitors coatings. Northrup Grumman investigated utilizing robotics to apply B-2 coatings several years ago, going through an exhaustive evaluation of 12 robotics-integrating companies before selecting CTA.

To take advantage of government and industry knowledge, the B-2 program office brought in Sandia Labs and Lockheed Martin, which developed and utilized robotics to apply coatings on F-22 components and RAM on the F-117.

"Their expertise and experience has helped us to mitigate our production risks," Mr. Kilburn said.

— Mr. Ray Dozier, OC-ALC Public Affairs



HyTech: Powering the Future

Propulsion Directorate powers air and space with hypersonic 'scramjet' program

Architect of American airpower, Gen. Hap Arnold, said it plainly and passionately — “The first essential of air power is pre-eminence in research.”

Scientists and engineers from the Air Force Research Laboratory Propulsion Directorate at Wright-Patterson Air Force Base, Ohio, are achieving the pre-eminent research Gen. Arnold called for — research that is helping the Air Force dominate air and space — now and in the future. In fact, for more than 85 years, scientists, engineers, support personnel and contractors from the propulsion directorate have been answering Arnold’s call for world-class research that puts capabilities into the hands of America’s warfighters.

Leading the way

Their goal is simple, according to director Col. Alan Janiszewski, “to lead the development of engines and power systems technologies for airplanes, missiles, launch vehicles and satellites.”

One of the most promising technologies already being ground tested in the directorate is a supersonic combustion ramjet (scramjet) engine that uses conventional jet fuels to reach hypersonic speeds — speeds over Mach 5. This technology has the potential to power future hypersonic vehicles such as cruise missiles, space access vehicles and long range strike and reconnaissance aircraft at speeds up to eight times the speed of sound, said Mr. Robert Mercier, deputy for technology in the aerospace propulsion office. Today’s aircraft and missiles fly in the Mach 0-3 range, he said.

Hypersonic technology

Dubbed “HyTech,” for hypersonic technology, the program got its start in 1995 in the wake of the cancelled National Aero-Space Plane program, Mr. Mercier said. That effort was aimed at developing a hydrogen-fueled, scramjet-powered, single-stage-to-orbit vehicle capable of aircraft-like horizontal takeoffs and landings.

The Air Force’s version of the scramjet, he said, is designed to run on JP-7 fuel, which is more logistically supportable than hydrogen fuelled engines. NASA continues to pursue the development of a hydrogen-fueled system with their “Hyper-X” program.

Anywhere, anytime

“By using hydrocarbon fuels, like JP-7, instead of hydrogen, we will be able to deploy these systems anywhere, anytime and any place,” Mr. Mercier said.

Tests underway right now are designed to demonstrate the operability, performance and structural durability of the scramjet system.

With more than 2,000 hours of testing under their belts, the directorate’s scientists and engineers, as well as contractors from Pratt and Whitney and United Technology Resource Center, have demonstrated the engine works and are excited about extending this technology to systems that will give warfighters a distinct advantage over future enemies.

Faster cruise missiles

According to Mr. Mercier, “the most strenuous near-term application is for a fast reaction, long-range air-to-ground missile cruising at Mach 6 plus — more than 4,500 mph.

“The missile would be launched from bombers or fighters then brought up to speeds of about Mach 4 using a rocket booster. The scramjet would then kick in, allowing the weapon to fly hundreds of nautical miles in minutes to reach time-critical targets,” he explained.

“This type of weapon would fly seven times faster than a conventional cruise weapon, and it could cover 49 times the area reachable with a conventional cruise weapon when carried from a single shooter,” he said. The maximum flight duration for this

hypersonic weapon would be about 10 minutes.

But getting to this point in scramjet development hasn’t been easy.

Fulfilling a vision

Propulsion experts today are just now demonstrating a nearly half-century-old vision of expanding the conventional jet engine operating range above Mach 5, Mr. Mercier said.

Scientists realized during early experiments that evolving the well known ramjet to a supersonic combustion engine was a very challenging and complex task.

Mr. Al Boudreau, HyTech’s program manager, has been working with hypersonics since the early 1960s. “It was pretty crude back then,” he said, “and the focus was on doing basic research to prove we could, in fact, light hydrogen in supersonic flight to produce thrust.”

Not only have they proven it works with conventional jet fuel, the HyTech team feels they’re chipping away at one of the last real frontiers of aeronautics, according to Mr. Mercier.

HyTech scientists used a building block approach to solve progressively more complex challenges using the

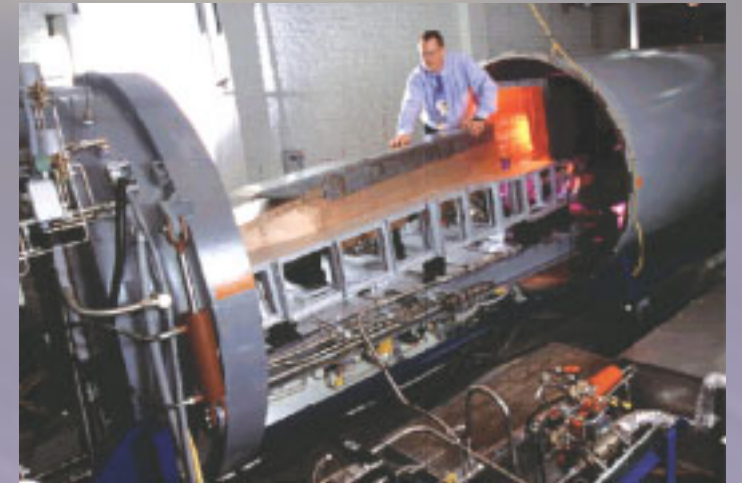
knowledge garnered from preceding tests.

One of the biggest challenges for successful and sustained running of the scramjet was creating a mechanism to ignite the fuel, something similar to a pilot light on your gas stove, Mr. Mercier said.

Overcoming challenges

“I’d liken the conditions as trying to light a match in a hurricane. The total time we have to inject the fuel, get the fuel vaporized, initiate combustion and complete combustion before a mass of air enters the combustor and goes through the nozzle is less than one millisecond — that’s not much time.”

Despite the challenges, Mr. Mercier believes the payoffs are



Left: The scramjet performance test engine, or PTE. Above: A specialist readies the new ground demonstrator engine, or GDE, scramjet in preparation for high speed wind tunnel tests at the GASL freejet facility in Ronkomkama, N.Y. Scientists and engineers from AFRL’s Propulsion Directorate and Pratt & Whitney are testing the second generation engine at Mach 4.5 and 6.5 speeds. The GDE is a full-scale, flight-weight powerplant combining lessons learned from the PTE. (Courtesy photos)

tremendous.

In addition to getting good engine performance and operability, the program is also aiming to build a durable engine that will provide affordable, reusable on-demand space access systems.

“Hytech is not just developing the engine body, but all the accessories that go with it,” Mr. Boudreau explained. “We’re talking about pumps and valves that can handle this very hot, reactive fuel — that’s never been done before. It’s a total engine package.”

Looking to the future

Near-term research and testing emphasis is on “expendables” like cruise missiles, “but the technologies we’re developing today could be applied to higher Mach reusable systems like long range strike and reconnaissance aircraft,” Mr. Mercier said.

Future hypersonic long range strike aircraft could reach any spot in the world within three hours and two-stage-to-orbit vehicles would give the Air Force affordable access to space.

— Mr. Michael Kelly, AFRL Propulsion Directorate

Almost from the dawn of powered flight nearly 100 years ago, the Propulsion Directorate has led the development of propulsion and power technology for platforms that operate within the earth’s atmosphere. Today this includes advanced turbine engines for aircraft like this conceptual Long Range Strike Aircraft that will use more inexpensive, efficient, and powerful supersonic cruise engines to reach time critical targets faster.

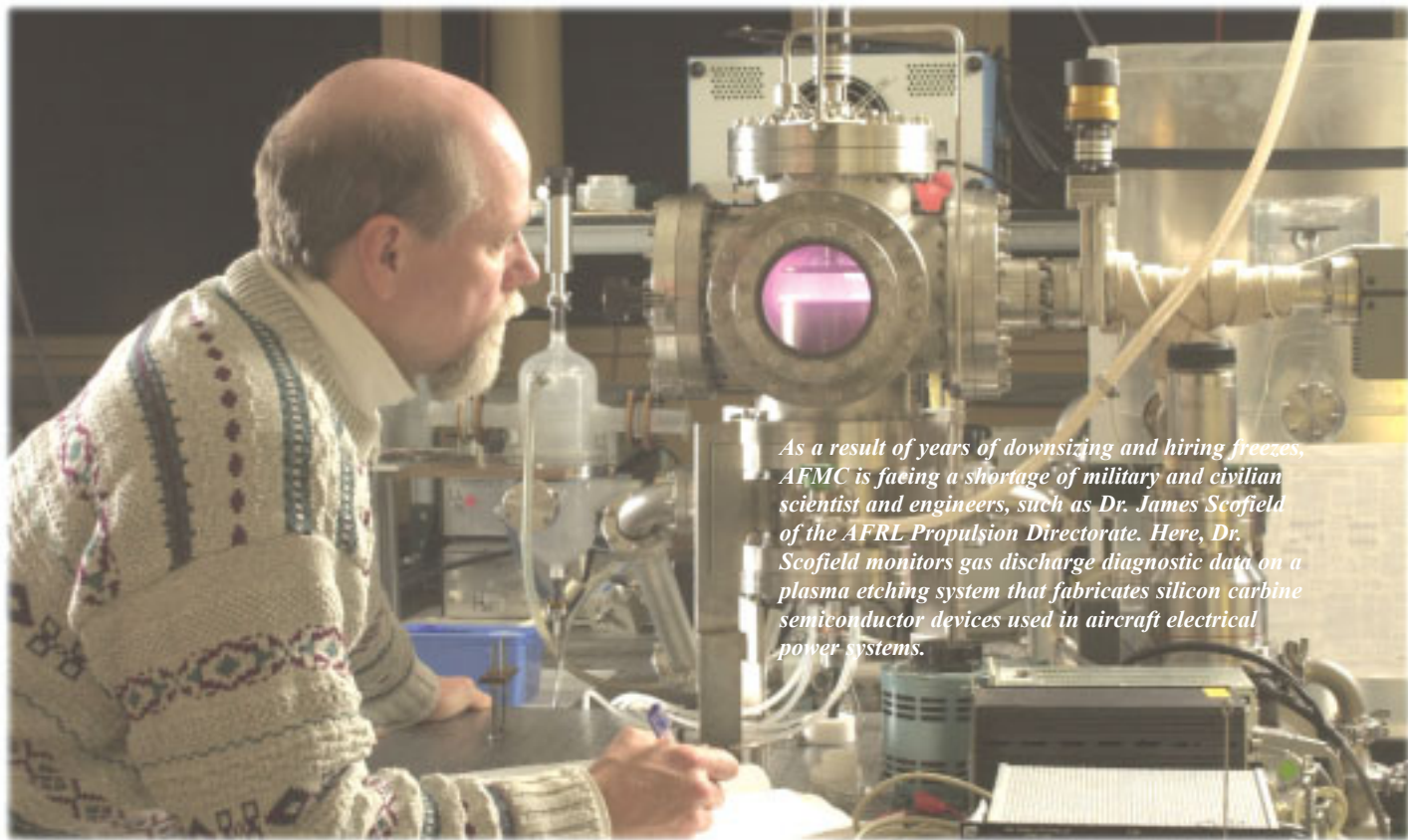


The Propulsion Directorate develops propulsion and power technology for systems intended to destroy, disrupt, or disable. Today this includes airbreathing and rocket propulsion for missiles, the fuels and propellants they burn, and power for evolving concepts in electrical weapons. Supersonic combustion ramjet technology being developed under the HyTech program will enable missiles to fly at speeds up to Mach 8. Such missiles could fly hundreds of miles in minutes to defeat time-critical targets.



Since the days of Sputnik, the Propulsion Directorate has developed propulsion and power technology for platforms placing payloads in orbit or that operate in space. Today this includes rocket and airbreathing propulsion concepts for launch vehicles, propellants and fuels for vehicles like this conceptual Two-Stage-To-Orbit space access vehicle, which will pave the way for low-cost access to space.





As a result of years of downsizing and hiring freezes, AFMC is facing a shortage of military and civilian scientist and engineers, such as Dr. James Scofield of the AFRL Propulsion Directorate. Here, Dr. Scofield monitors gas discharge diagnostic data on a plasma etching system that fabricates silicon carbide semiconductor devices used in aircraft electrical power systems.

Command leaders say YES to scientists, engineers

As scientifically developed precision-guided weapons and unmanned aerial vehicles help fight terrorism around the globe today, Air Force leaders are battling a shortage of the very scientists and engineers who created that weaponry.

Of the Air Force's 13,300 military and civilian scientist and engineer authorizations, the service is short about 2,700 — or about 20 percent, according to Mr. Scott McLennan, Air Force Materiel Command system integration engineer. That's if they only had to fill current vacancies.

A growing problem

Since AFMC employs the lion's share of Air Force scientists and engineers, the fact that a decade of downsizing and hiring freezes has made up to 70 percent of its civilian workforce, including scientists and engineers, retirement eligible in the next five to seven years is another looming problem, according to Gen. Lester Lyles, AFMC commander. He said if this trend is left unchecked it could pose a possible readiness problem for AFMC and the Air Force. Losing its home-grown scientific and engineering capabilities could force the world's most prominent air power to contract out some of those needs.

"In AFMC our mission is to provide the tools for the warfighter, and if we're not able to meet and understand the needs of the warfighter with our own organic capabilities we're not going to be as well off as we need to be," he said. "If we

have to contract it out, I think we're going to lose. Whether it's in terms of dollars or the linkage to the warfighters and rest of the Air Force, I think we will definitely lose."

Mr. James Papa, AFMC engineering and technical management director, agreed saying, "We're going to be taking on more and more risk of our development programs failing without proper oversight from our own organic workforce. We're going to be increasing the cost of doing business in some cases by having to contract out some of our engineering support."

"If we don't maintain our own organic capability for oversight of the people we're asking to build our systems for us, we lose the expertise to define what our systems ought to be and make sure they're done properly. Then we'll wind up with systems that don't meet cost or schedule or have performance problems."

Year of the Engineer

To help bring the situation to Air Force and command leaders' and everyone else's minds, and to find solutions, Gen. Lyles declared 2002 as the Year of the Engineer and Scientist, more commonly known as YES.

The hope is that this initiative will remind everyone that scientists and engineers take concepts and ideas born in laboratories and turn them into active and working weapon systems, Mr. Papa said. Then they'll sustain those systems on through aging and retirement.

The YES is focusing on three main areas: workforce training and development; workforce size and mix; and motivation, Mr. Papa said.

"We're currently working initiatives and legislation in all these areas," he said. "It's just going to take some time to get what we need in place, up and running."

Limited resources

Another hurdle AFMC and Air Force officials have to clear is competition for retaining people because they're in demand on the outside. Mr. Papa said the nation as a whole has had lower and lower production numbers of engineers out of colleges so scientists and engineers are becoming a very valuable commodity.

"As a nation we're going to be constantly fighting over a limited resource," he said. "In the case of the Air Force, we're going to be in the middle of that battle for talent." Other hurdles AFMC and Air Force scientist and engineer recruiting faces is a disproportionate age distribution in the workforce, according to Mr. Papa.

"We have a gap in the middle and lower civilian grades because of hiring freezes during the years and also a lack of accessions in the military," he said. "So we have about 70 percent of our folks eligible to retire by 2007. If we do nothing, we're going to see the whole problem aggravated by a continuing exodus of our senior people and no seed corn to bring in behind them."

For people considering scientific and engineering work for the Air Force, Mr. Papa said there's a lot of opportunities available.

People in these fields are involved in leading edge activity and get increased responsibility sooner in their careers, he said. They also get involved in some very exciting things and contribute to the country's strength, well being and military power.

A rewarding career

"We're never going to offer the kinds of opportunities like stock options and gigantic six-figure salaries that maybe young people feel they can have in the world of dot-coms and other higher risk businesses," Mr. Papa said. "But there are a large number of folks who find working for the Air Force a rewarding career and they are the kind of folks we're looking for."

While AFMC is seven months into the Year of the Engineer and Scientist, it's too early to tell what impact the initiative has had on the problem. "It takes a while to understand whether we've turned anything around, but we're anticipating by next year we'll be able to have a way to look back on that to see if anything has improved," Mr. Papa said.

To make sure enough emphasis is placed on the problem and solutions reached, Gen. Lyles said AFMC's Year of the Engineer and Scientist will continue into 2003.

— Tech Sgt. Carl Norman, AFMC Public Affairs

Command aims at handling shortage

A three-pronged approach is how Air Force Materiel Command officials hope to fill 2,700 scientist and engineer vacancies and prepare for up to 70 percent of its civilians currently in those jobs to retire soon.

Part of AFMC's Year of the Engineer and Scientist initiative to focus attention on the problem, command officials are aiming at three main recruiting areas — workforce training and development, workforce size and mix and motivation, said Mr. James Papa, AFMC engineering and technical management director.

Sustaining technological dominance

"It's through the scientist and engineer corp that we sustain what's very important — technological dominance on the battlefield," he said. "It goes beyond just producing state-of-the-art systems, we need to have a robust scientist and engineer corps to be on the leading edge and stay ahead of our adversaries."

Of the three-pronged approach, Mr. Papa said workforce training and development looks at what kinds of experience scientists and engineers should have in their career; what kind of training they should have and when they should have it; along with what kind of career paths and promotion potential they should have. AFMC initiatives to attack those obstacles include increased educational opportunities and improvements in career development.

Workforce shaping

The motivation area deals with making sure scientists and engineers are recognized for their accomplishments and provided fair compensation. "We've looked at market comparison and what engineers in industry are receiving in terms of starting salaries and middle salaries, and there's a gap there," Mr. Papa said. "We're trying to work the funding process with the air staff in building initiatives for recruiting and retention bonuses and salary adjustments that would make things more in line with the market we have to compete with for scientists and engineers."

Workforce size and mix involves having a good handle on what the command and Air Force requirements are for scientists and engineers.

Currently, AFMC is about 85 percent manned for scientists and engineers on the civilian side. However, military scientist manning sits at about 80 percent and dips down around 62 percent for engineers.

Looking ahead

What the future holds for Air Force scientists and engineers is unclear. But Gen. Lester Lyles, AFMC commander, said he's pleased with what his command is doing to work its way through the mire. "From the perspective of things that we're doing to try and understand the problem and address those things we understand, I feel very pleased," he said.

Gen. Lyles designated 2002 as the Year of the Scientist and Engineer, but to ensure emphasis is placed on the problem, he said the effort will continue into 2003.

— Tech Sgt. Carl Norman, AFMC Public Affairs



Wichita media views Airborne Laser

KIRTLAND AIR FORCE BASE, N.M. — With the Airborne Laser as a background, Col. Ellen Pawlikowski, director of the Airborne Laser System Program Office here, briefed Wichita news media representatives about the aircraft, which recently flew following two years of major modifications here. In addition to speaking to approximately a dozen news media, the colonel was interviewed for a program titled “Ultimate 10: Military Machines” that will air on the Learning Channel.

— Reported by AFRL Public Affairs

Kirtland removes underground storage tanks

KIRTLAND AIR FORCE BASE, N.M. — Kirtland is the first base in the Air Force Materiel Command to be free of regulated underground storage tanks, protecting the environment against future leaks and spills and eliminating the need for state regulation and inspection.

Once a storage tank is removed and a need still exists for storage, Kirtland has opted to put in replacement tanks encased in concrete, allowing access for inspection.

These tanks are no longer considered underground. Should a spill or leak occur, it will be contained in the vault and easily cleaned.

— Reported by the 377th Air Base Wing

AMARC receives first B-1 Lancer for storage

DAVIS-MONTHAN AIR FORCE BASE, Ariz. — The first of two dozen aircraft to be stored as part of the Air Force’s B-1 Lancer fleet reduction plan recently arrived at the Aerospace Maintenance and Regeneration Center.

The arrival starts a reduction process that will take the Air Force’s B-1 fleet to 60 from its current 92 count — 24 will be stored at AMARC and another eight will be placed on static display at various Air Force installations.

Of the 24 aircraft to be stored at AMARC, 10 will be placed in an inviolate storage where they’ll be preserved and stored intact to anticipate future operational requirements. Fourteen will be placed in an excess storage category where engines and selected parts may be removed and returned to the Air Force supply system.

As a result of the reductions, bomber operations have already ceased at McConnell AFB, Kan., Robins AFB, Ga., and Mountain Home AFB, Idaho. The remaining active B-1 bomber fleet will operate from Dyess AFB, Texas, and Ellsworth AFB, S.D.

AMARC experts will continue receiving the bombers through fiscal year 2003. The Lancers will take their place among the 4,500 viable aircraft assets already in storage here.

— Reported by AMARC Public Affairs

U.S. Air Force Museum offers look ‘behind scenes’

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Members of the public are invited behind the scenes for a close-up look at the fascinating process of aircraft restoration.

Participants in the Behind the Scenes Tour will walk through the Museum’s Restoration area located in hangars on the historic Wright Field flight line in Area B of the base, about one mile from the main Museum building. Visitors will see a variety of aircraft, in varying stages of the restoration process. As part of the tour, they’ll see the Museum’s newly acquired

B-2 Stealth Bomber in the final stages of restoration before it’s placed on public display, and witness the painstaking craftsmanship required to restore a 1918 World War I SPAD XIII.

Also on the tour, visitors will view the exhibits area, where the dioramas and displays seen on the museum floor get their start.

Interested individuals can now register for the fall and winter “Behind the Scenes” tours, scheduled on the second Friday of October, November and December. The tours are free and last from 12:15 to 3:15 p.m. Space is limited, so advance registration is required, and group reservations are not accepted.

To make tour reservations or for more information, call the museum at (937) 255-3286, Ext. 302. The museum is located six miles northeast of downtown Dayton.

— Reported by U.S. Air Force Museum Public Affairs

AFRL technical library shares resources

ROME, N.Y. — A history of research dating back more than a half century has resulted in the Technical Library of the Air Force Research Laboratory here being recognized throughout the world of radar as a valuable resource.

The library makes its information resources on radar, signal processing and a variety of other electronics subjects available to many requesting institutions and individuals through interlibrary loans.

The Rome Research Site library is stocked with 23,000 books — primarily technical publications — as well as a large collection of technical magazines and journals. All are available through interlibrary loans.

Air Force research and development at Rome was established in June 1951 with the Rome Air Development Center. Radar technology was the primary focus of early activity, and the legacy continues with elements of the AFRL Sensors Directorate still active at the Rome Research Site.

— Reported by AFRL Public Affairs



Air Force photo by Staff Sgt. Vincent Parker

Hill experts renovate F-16s for Thailand

The first five F-16 Fighting Falcons of 16 being renovated by aircraft experts at Hill Air Force Base, Utah, left for Thailand recently. The remainder of the modified fighters are scheduled to join the Royal Thai air force by January.

The F-16s, which will be used as air defense fighters, were brought here from Davis-Monthan AFB, Ariz., in pieces on flatbed trucks last September, after being in cocoon storage for several years. Once delivered to Hill’s aircraft directorate, workers began disassembling them to look for any complications that may have prevented them from operating at maximum efficiency.

“Each plane had 180 flow days. That’s the amount of time from when we get them to when they’re ready for delivery,” said Mr. Wayne Hansen, F-16 production chief foreign military sales regeneration section.

Mr. Brandon Bodily, lead mechanic, said crews haven’t run into many prob-

lems and the birds “look pretty good considering how long they’ve been mothballed. There was almost no corrosion damage.”

Of all the hurdles maintenance crews have faced, Mr. Bodily said getting parts has been one of the most challenging. “But we’re still meeting or beating our deadlines.” He said crews put in about 1,800 hours to take each plane apart and put it back together like brand new. Systems are checked out and modifications made to make the newest F-16s to Thailand’s aerial fleet the best.

As the F-16s arrive, electricians first make sure the array of wires and systems in the plane is ready.

“We hook the plane to an electrical checkout stand and that tells us where the problems are,” said Mr. Jerry Hunter, aircraft electrician. “We strip them down before they go to the sheet metal shop, then we build them back up after they’re done with them there. What we can’t repair, we replace. The planes come to us

in pieces and our job is to put them back together.”

After the aircraft is reassembled and ready, it goes to flight test where crews troubleshoot to find any complications before it returns to the sky for test flights.

“On these particular aircraft a big concern was the fuel system because the pilots were flying across the Pacific and were going to be hooking up with tankers almost the whole way,” he said. “It was a good feeling to come in the day after they left and hear they all landed at Hickam AFB, Hawaii, in perfect condition and ready for the next leg of their ferry to Thailand.”

After Hawaii, the F-16s went to Guam and then to Korat Royal Thai Air Force Base, Thailand, where they joined the nation’s 36 air defense fighters Aug. 17.

The program is expected to cost \$138 million. Thailand will receive 16 F-16s plus two additional unassembled aircraft for spare parts.

— Mr. Gary Boyle, OC-ALC Public Affairs

Air Force, Lockheed leaders give F-22 update live from Farnborough

Top Air Force and Lockheed Martin officials attending the Farnborough, England, airshow, recently came together with their colleagues via satellite to update the world on the F-22 Raptor flight test program.

Secretary of the Air Force Dr. James Roche and Mr. Dane Hancock, executive vice president of Lockheed Martin Corporation, began the live broadcast. The two were joined via satellite by Maj. Gen. Doug Pearson, commander of the Air Force Flight Test Center at Edwards Air Force Base, Calif., Mr. Bob Rearden, Lockheed's F-22 program general manager and Mr. Bret Luedke, Lockheed's chief F-22 test pilot.

Seated in front of Raptor 4005, the three talked about F-22 flight testing progress from inside the F-22 Combined Test Force complex at Edwards. The group's opening comments were followed by a brief question and answer session from international media representatives gathered at the airshow.

Making key decisions

According to Gen. Pearson, the test program is in "full swing." To date, the team has flown more than 950 flight test sorties and accumulated more than 2,100 hours of flight time.

In an effort to keep F-22 flight tests on track, senior Air Force leaders, including Secretary Roche, recently gave Gen. Pearson greater responsibility to look at priorities for test activities and to make key decisions to support the F-22 test force. "We have exercised the aircraft across much of its intended envelope, launched missiles and continue today to fully mature this outstanding fighter design," Gen. Pearson said.

Today, there are five F-22s flying every day here. Raptors 4002 and 4003 are continuing to expand the flight envelope and are routinely flying at high Mach, high loads and maneuvering at high angles of attack. Ships 4005, 4006 and 4007 are conducting avionics systems development tests to help test team members fully understand how the aircraft will perform in future anticipated combat environments.

In addition, Raptors 4001 and 4004 are undergoing ground tests while 4008 receives modifications to support initial operational testing set to begin in the summer of 2003.

Breaking barriers

So far, the team has been impressed with the capabilities the Raptor will bring to the fight. "The F-22 is the most capable, complex and lethal fighter ever built; each day it breaks new bar-

riers and takes us into new territory," said Gen. Pearson. "It's an awesome aircraft that will kick down doors, clear the skies of any enemy and provide air dominance for the United States and her allies for many decades to come."

Initial testing

The general shared his experience chasing the F-22 in an F-15 Eagle with the audience. "I can tell you that it's impossible to keep up with the Raptor when it even begins to stretch its legs or open its lethal jaws," he said. "Like other chase pilots, I often find myself out of airspeed, out of altitude, out of fuel and out of ideas as the Raptor just keeps on going, and going and going."

According to Mr. Rearden, Gen. Pearson and the test force at Edwards can expect to receive its last three test aircraft by the end of this year. Those aircraft are nearing completion at Lockheed's plant in Marietta, Ga., and will be delivered to Edwards in the next couple of months.

These final test aircraft, along with two earlier ones, will be used to support initial operational testing, he said. They will also be used to train the initial cadre of F-22 operational pilots.

Coming together

During the event's question and answer portion, Gen. Pearson said a number of elements must come together before initial operational testing can safely begin. The test team has to ensure the aircraft's software and subsystems are performing as they should, and it also has to clear the Raptor's flight envelope.

In preparing for producing additional Raptors in the near future, Mr. Rearden said Lockheed Martin is in the final phases of a \$155 million capital investment effort. The investment will allow the company to build robotic paint barns, radar cross-section verification facilities and other facilities necessary to build large quantities of F-22s.

The company has also completed initial fatigue and static testing of the F-22 using non-flying, ground-based airframes at Marietta. Those tests have proved the jet is as strong and durable as we designed it to be, he said.

Gen. Pearson said he's confident in the test work completed to date and is committed to delivering the Raptor to the warfighter. "I hope my son, a lieutenant today, is fortunate enough to fly and employ the Raptor one day. I know it will always bring him, and all other sons and daughters, home — successful against any enemy."

— Ms. Leigh Anne Bierstine, AFFTC Public Affairs

Security forces members honor their four-legged partners as service ends

The deployment days number almost a thousand between the two of them, and their on-duty successes include major drug busts and supporting the Oklahoma City bombing recovery.

So when it came time for them to retire from Air Force service, 72nd Security Forces Squadron members at Tinker Air Force Base, Okla., wanted to do it right. At a recent ceremony, military working dogs Remco and Ringo completed their Air Force careers with nine and 12 years of service, respectively.

"They've served their country just like everyone else," said Tech. Sgt. Jerry Mitts, kennel master. According to Maj. Joe Hogan, 72nd SFS commander, Remco and Ringo, along with the other dogs, live to work and please their handlers. "They're all heart. It's time for them to enjoy their final years without the stress we place on our military working dogs."

With full honors

With that, the citation to accompany the dogs' Air Force Commendation Medals was read and Maj. Hogan placed a medal around each dog's neck. Then, the retirement orders were published and Remco and Ringo gobbled down treats Maj. Hogan presented.

Remco is an explosives detector and patrol dog who searched more than 50,000 vehicles and 6,000 buildings during deployments supporting Operation Southern Watch. Ringo is a narcotics detector and patrol dog who has conducted more than 90,000 vehicle inspections and 43,000 building searches during his career. Both are Belgian Malinois.

Security forces members conducted the retirement ceremony because the bond between the military working dogs and their handlers is strong and evident in every scratch on the head and every reciprocal wag of the tail, Sgt. Mitts said. They work extensive hours together, usually more in a week than regular security forces members.

"When the rest of the guys go home, these guys are still down here taking care



After serving nine years as an explosives detector and patrol dog at Tinker AFB, Okla., Remco enjoys a congratulatory head scratch from Senior Airman Edwin Hernandez, from the 71st Security Forces Squadron at Vance AFB, Okla. (Photo by Ms. Margo Wright)

of the dogs and come in on their days off and do training," he said. The dogs and their handlers work 12-hour shifts, three days on and three days off. When eight-hour shifts are in effect, the dogs work six days a week.

"After working with the dogs for a long time, you find they're just like people," Sgt. Mitts said. "They have good days and bad days and show their individual personality traits."

Although Remco and Ringo were considered active duty until mid-July, both dogs stopped patrolling at Tinker earlier this year. Remco, whose health is failing, is being adopted by a military working dog trainer, Staff Sgt. Joseph Suafoa.

Ringo, whose health prevents him from deploying to areas without vet facilities, is able to patrol locally and has been adopted by the Del City Police Department, living with Patrolman Loyd Berger.

Life after the military

"I'd been interested in being a canine officer, but we just didn't have the budget

right off and I didn't have the experience," Officer Berger said. "I thought it would make a good match. With his experience, he could basically train me."

This approach is working, but both Officer Berger and Ringo had some things to get used to since the new partnership was a change in lifestyle for them both. "I was kind of worried about how he would react around family, but he's just been an excellent dog," he said.

A show of respect

As a final show of respect at the ceremony, dog teams from Tinker and Vance AFB, Okla., held a pass in review for the retiring dogs.

While Ringo and Remco stood panting, their newly acquired medals glinting in the morning sun, the teams of two quickly passed before them. The handler gave a sharp salute to the former brothers in arms while his four-legged partner trotted quickly beside, head high, tail swinging in the familiar stride of the military working dog.

— Ms. Amy Schiess OC-ALC Public Affairs

AFRL personnel take to the field

Nearly two dozen Air Force Research Laboratory company grade officers and enlisted personnel “walked a mile in the warfighters’ boots” — spending the first two weeks of June in the field at Fort Drum, N.Y., during Team Patriot 2002.

Fort Drum, home to the Army’s 10th Mountain Infantry Division, and the AFRL Rome Research Site were the principle locations for the annual event that brings together active duty Air Force and Army units, supported by National Guard and Reserve units from across the eastern United States.

Equipped for realistic scenario

The exercise provided a comprehensive joint training environment, centering around a third-world country scenario which required Army and Air Force security forces, logistics, command and control, artillery and close air support.

Ops tempo called for 24/7 operations in low intensity and medium intensity conflict situations. Urban warfare and small unit tactical maneuver were conducted using small arms — M-16, M249, M-2 — with MILES equipment for realism and evaluation purposes.

Unique to the 2002 exercise was the extensive participation

by AFRL members from Rome, Hanscom Air Force Base, Mass., and Wright-Patterson AFB, Ohio. Both officers and enlisted members participated in a concentrated indoctrination package designed to bring research scientists and engineers closer to the warfighter.

Specialized deployable equipment

AFRL personnel underwent combat arms training and deployment under field conditions. They also participated in all ground defense and small unit tactical training, serving both the defending forces and the aggressors during different scenarios.

Emerging and innovative technology was also spotlighted at this year’s exercise. At the Forward Operations Center, the AFRL Information Directorate’s Deployable Data Wall served to provide a dynamic resource for collating and displaying the battlefield status and tracking the progression of the “war” at various geographical locations. This was similar to a data wall which AFRL loaned the 10th Mountain Division for use in their initial deployment to Afghanistan last year.

The laboratory’s Mobile SATCOM vehicle provided roving support across the battlefield, providing “reachback” communications in support of command and control, battle damage

assessment, and situational awareness. The Mobile SATCOM’s data capacity exceeds the conventional combat communications deployable satellite system, while being only 1/200th the size and weight.

Room for improvement

One of the most exciting “fast track” technology demonstrations was the integration of battlefield targeting and data link technology. Motivated by the unfortunate death in Afghanistan of a tactical air controller who created a targeting error while manually calculating target coordinates, AFRL engineers successfully automated target acquisition technology with the data link communications device.

This integration allowed the operator to lase a target, automatically create the target’s GPS coordinates, and then transmit the resolved coordinates automatically to waiting Close Air Support aircraft. This formerly manual process has now been re-defined to “aim-validate-transmit-kill.”

An additional experiment in support of

the tactical air control operations involved use of personal data assistant devices on the battlefield, networked with the rear Air Support Operations Center and the Army’s rear Tactical Operations Center. The network connection was accomplished with Motorola Iridium satellite telephones equipped with new secure voice and data modules providing the same level of security as a STU-III.

Community involvement

Homeland Defense technology demonstrations included the use of amateur radio operators across the nation to track aircraft otherwise below the FAA radar coverage area or with their transponder turned off.

The project successfully tracked a civil aircraft across the Northeast, which otherwise may not have been detected by the FAA. This low-cost alternative to building hundreds of new radars across the county could have prevented the “disappearance” of the hijacked aircraft last Sept. 11, when terrorists took control, flew below 10,000

feet and turned off the aircrafts’ transponders.

Unmanned aerial defense

AFRL scientists and engineers also experimented with perimeter detection technology called SensIT. This package included acoustical, thermal and magnetic sensors which automatically “self-networked” to report detections to a small, locally controlled Unmanned Aerial Vehicle. The aircraft, which also boasts a remote video capability, is envisioned to provide deployed units with the ability to surveil local terrain and monitor transit routes with a small, easy-to-use system requiring little logistical support.

Team Patriot 2002 was a valuable experience, not only for the AFRL personnel who spent two weeks amongst the pine forests of northern New York, but particularly for those warfighters who will soon be benefiting from the improved technologies being developed by AFRL.

— Reported by AFRL Public Affairs



An observer-controller from the West Virginia Army National Guard briefs Air Force Research Laboratory personnel during the Team Patriot field exercise at Fort Drum, N.Y. (Air Force photo by Mr. Albert Santacroce)



Personnel from Air Force Research Laboratory engaged in satellite communication experiment at Fort Drum as part of the Team Patriot Exercise. (Air Force photo by Mr. Albert Santacroce)

Aviation legend to give up military flying after airshow



Brig. Gen. Chuck Yeager waves to the crowd after his F-15 flight during one of his several visits to Edwards AFB, Calif. (Courtesy photo)

Gen. Yeager added this year's open house is especially important in light of last year's tragic events and said the public is ready to once again see what the Air Force has to offer.

"People always love to come out to Edwards because they can see some very exotic airplanes," he said. "It's good to see people bring their kids, and there is no where in the world you can hear a sonic boom like they will hear here."

The 'old' with the 'new'

Maj. Gen. Doug Pearson, commander of the Air Force Flight Test Center, said there is no doubt that the flight test legend will be a great crowd pleaser this October.

"He ties our past with our future," Gen. Pearson said. "General Yeager is such a piece of our heritage here at Edwards, but yet he is so much into our future and very much in touch with what we are doing here today."

Showcasing capabilities

Gen. Pearson added that the entire base is pulling together to ensure a successful air show for all those heading to Edwards in October.

"We are looking forward to showing the public our current state-of-the-art military capabilities," he said. "That is really what this airshow is all about."

Fans of the flight test legend can look for him to return to Edwards for the official opening of the Open House and Air Show in October. For more details on the event see the Edwards Web site at <http://www.edwards.af.mil>.

— Ms. Leigh Anne Bierstine, AFFTC Public Affairs

Aviation legend and retired Brig. Gen. Chuck Yeager will have been flying military aircraft for more than 60 years, and during a recent visit to Edwards Air Force Base, Calif., he said there was no better way to mark the occasion than by kicking off this year's open house in an F-15 Eagle along with his long-time friend and colleague retired Maj. Gen. Joe Engle.

He was at the base to chat with airman and to prepare for his opening flight at the Edwards 2002 Open House and Air Show Oct. 26.

Not 'business as usual'

"It's very unusual that we can still do the opening together," he said. "But the Air Force and the Flight Test Center have given us the opportunity and we are taking advantage of it."

Reflecting on his 60 years of flying, Gen. Yeager said he has been "very, very lucky" in being afforded the opportunity to fly military aircraft for six decades. After retiring from the Air Force with more than 34 years of service including in World War II and Vietnam, he continued flying as a consultant test pilot at Edwards logging time in the F-15 and the F-16 Falcon among others.

However, it appears Gen. Yeager's time flying military aircraft may be coming to a close after his approaching open house mission.

A surprise announcement

"I have decided that during the open house and airshow I'll make a sonic boom in the F-15, but sixty years is long enough for me to be flying military airplanes," he said during the visit.

The retired general is quick to point out that he is not giving up flying all together. He plans to continue flying P-51 Mustangs and various light aircraft.



Senior Airman Theresa Ide has 14-inches of hair cut off by Ms. Christina Ganley, at the base beauty shop at Hanscom AFB, Mass. Airman Ide donated the hair to Locks of Love, a charity that provides hairpieces to children suffering from medical illnesses. (ESC photo)

Airman donates 14-inches of hair to Locks of Love

Senior Airman Terry Ide, from the Electronic Systems Center Public Affairs at Hanscom Air Force Base, Mass., had two choices when it came to wearing her hair in uniform. She could cut it or wear it up.

For the past four years, Airman Ide has worn her hair in a tight bun to meet uniform requirements. But this recently changed when she has 14 inches of it cut off at the base beauty shop and then

donated to Locks of Love, a non-profit organization that provides hairpieces to financially disadvantaged children across the country who suffer from long-term medical hair loss.

"I have been thinking about cutting my hair for awhile now, but being pregnant and tired all of the time gave me the final push," Airman Ide said. "I was at the end of my first trimester when I cut my hair and it was a way of celebrating. My whole life is about to change anyways, why not the hair too?"

According to the Locks of Love Web site, the donated hair is used to make hairpieces for children who have lost their

hair due to alopecia areata, an autoimmune condition with no known cause or cure, or those who have suffered from severe burns, radiation treatment to the brain stem or dermatological conditions that result in permanent hair loss.

"Growing up is hard enough, I can't imagine having to do it with an illness," Airman Ide said. "My contribution might help one little kid gain more confidence and have an easier time around other children."

— 2nd Lt. Stacie Shafran, ESC Public Affairs

RAF group awards first outside commendations

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — An Aeronautical Systems Center logistics specialist here is one of only two Air Force civilian employees to recently receive a Royal Air Force 2 Group commendation.

Ms. Edlene Flannery, C-17 System Program Office's support systems integrated product team deputy chief of logistics, received what RAF Air Commodore Nigel Bairstro called the highly prestigious Air Officer Commanding 2 Group Commendation Award.

Ms. Flannery and Ms. Donna Parker, instructional systems specialist at Air Education and Training Command headquarters, are the first people outside of the United Kingdom to receive the award.

The award citation credits her for making sure that support systems were in place and ready for the first United Kingdom C-17 to be delivered within a year of her May 2000 tasking. She executed a support sustainment program for the aircraft that required arranging budgeting and funding, executing contracts, evolving maintenance, technical support and documentation and procuring spares and specialist support equipment.

According to Commodore Bairstro, presenting Air Officer Commanding 2 Group Commendation Award is rare and indicative of the RAF's feeling that the recipients are truly part of the 2 Group team.

— Reported by ASC Public Affairs

DOD presents distinguished civilian service award

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Mr. Fredric Schwartz was presented with the Department of Defense Distinguished Civilian Service Award for his exceptionally distinguished civilian service as the technical director, Joint Stride Fighter Program, from August 1998 to October 2001.

Mr. Schwartz provided the technical leadership, foresight and vision that transformed this effort from a set of complex multi-faceted technology and "X" aircraft demonstrations to an extremely cohesive,

well-focused major acquisition program. The application of these advances will provide our warfighters and our allies a lethal, survivable supportable and affordable strike fighter for the 21st century.

Mr. Schwartz is a "plank-holder" on the joint strike fighter, having been hand-picked by the Air Force in 1994 to be its senior civilian representative. He established new benchmarks for multi-service cooperation, simulation-based acquisition, lean aerospace practices, spiral development and acquisition excellence for the largest acquisition program in the Defense Department's history.

In addition, Mr. Schwartz devised and championed an international cooperative development strategy resulting in unprecedented participation and early buy-in by the United States' most important allies. The results of this strategy will provide our theater commanders a more effective coalition warfare package; and the international aircraft sales generated will continue to predominate as a positive balance of payments contributor.

This is the largest international cooperative development program in United States history.

— Reported by JSF Program Office

ACS chemistry award recipient announced

EDWARDS AIR FORCE BASE, Calif. — Dr. Karl Christe has been named the recipient of the American Chemical Society's 2003 Inorganic Chemistry Award.

Dr. Christe is an inorganic research chemist and senior staff advisor at the Air Force Research Laboratory's Edwards Research Site where he helps lead efforts on promising high energy density matter chemistry.

Since 1998, Aldrich Chemical Co., Inc., has sponsored the ACS Inorganic Chemistry Award. Dr. Christe's award will be presented on March 25, 2003, at the 225th ACS National Meeting in New Orleans, where he will present a major address on his research to the ACS's Inorganic Chemistry Division at that meeting.

— Reported by AFRL Public Affairs

Two selected as Air Force 2002 outstanding airmen

WRIGHT-PATTERSON AIR FORCE BASE, Ohio — Two Air Force Materiel Command senior enlisted members were among the 12 Air Force Outstanding Airmen of the Year for 2002. They are:

— **Master Sgt. Timothy Garland**, an Airborne Warning and Control System communications systems flight superintendent at Tinker AFB, Okla. Sgt. Garland heads a team of 60 technicians there.

— **Master Sgt. Taru Taylor**, selected for his work with the wholesale logistics career broadening program at Hill AFB, Utah, where he was stationed from June 1999 to June 2002. He has since relocated to Maxwell AFB-Gunter Annex, Ala., where he is a logistics integration-modernization program manager.

The two were chosen from a field of 45 members representing organizations at all levels of command throughout the Air Force, and were recognized during the Air Force Association National Convention in Washington in September.

— Reported by AFMC Public Affairs

Tinker teen named Air Force Youth of the Year

TINKER AIR FORCE BASE, Okla. — A Tinker teen returned from Washington, D.C., recently as the newly crowned Air Force Youth of the Year for 2002. Mr. Michael Goodman received his trip to Washington after winning the Oklahoma Boys and Girls Club and then the Air Force Materiel Command Youth of the Year awards earlier this year.

He was among eight youths selected from 76 regional winners across the Air Force for their community service, leadership qualities and outstanding character.

Mr. Goodman, who volunteers with the Tinker Youth Center, stays active at school and is a member of the Oklahoma City Youth Council, stood out from the crowd.

His prizes included more than \$2,000 for college, a Disney trophy and an all-expenses paid trip to the Capitol.

— Reported by OC-ALC Public Affairs

AFMC leader earns engineering lifetime achievement award

Determined leadership and generosity in sharing his experiences has led academic and industry officials to present the Air Force's only African-American four-star general with the 2003 Black Engineer of the Year Award for Lifetime Achievement.

Gen. Lester Lyles, Air Force Materiel Command commander, Wright-Patterson Air Force Base, Ohio, will receive the award at the 17th annual Black Engineer of the Year Awards set for Feb. 15 in Baltimore. The award is presented on behalf of the Council of Engineering Deans of the Historically Black Colleges and Universities, Lockheed Martin Corporation, DaimlerChrysler Corporation and U.S. Black Engineer & Information Technology magazine.

Hard work pays off

"It's very meaningful to me that this comes from the deans of prestigious engineering schools, most of whom are not in any way associated with the Air Force," Gen. Lyles said. "This recognizes that hard work, perseverance and dedication always pay off and validates what I tell others in mentoring or counseling sessions — these are the ingredients to success in any endeavor."

Setting the tone for this honor, Mr. James Johnson, dean of Howard University's College of Engineering, Architecture and Computer Sciences, reflected on a recent Gen. Lyles appearance at the college's leadership institute which introduces students to



Gen. Lester Lyles, Air Force Materiel Command commander, is being awarded the 2003 Black Engineer of the Year Award for Lifetime Achievement. Gen. Lyles will receive the award at the 17th annual Black Engineer of the Year Awards in February in Baltimore, Md. Here, Ms. Theresa Farris, a subunit chief in the KC-135 sheet metal structure unit at Tinker AFB, Okla., points out a special fixture underneath a KC-135 undergoing programmed depot maintenance. (OC-ALC photo)

leadership principles.

Inspirational

"He told of a teacher he had one time who gave them a problem, and if any part of the answer to that problem was incorrect, the entire problem was wrong," Dean Johnson said. "I think that sets the tone for the excellence he carries today. He set a very high bar for our students to follow."

In addition to leadership and role-model qualities, the nine-member Council of Deans of the Historically Black Colleges and Universities chose Gen. Lyles for the award because of the general's career progression and contributions he's made at each level.

"Starting as a lead engineer and going to a four-star general in the Air Force, everything he's done he's done with dignity and style," said Mr. Dean

Johnson, who was Gen. Lyles' college classmate in the late 1960s. "I believe the real value of this award is that it will highlight for thousands of young people the vastness of the opportunities that await them."

A full career

Gen. Lyles' Air Force career began in 1969. He's seen duty as program element monitor for the Short-Range Attack Missile; tactical aircraft systems director; and director of the medium-launch vehicles program office.

He's also served as Ogden Air Logistics Center commander at Hill AFB, Utah; Space and Missile Systems Center commander at Los Angeles AFB, Calif.; and Air Force vice chief of staff.

He holds a bachelor's degree in mechanical engineering from Howard University in

Washington, D.C., and a master's degree in mechanical and nuclear engineering from the Air Force Institute of Technology Program, New Mexico State University.

It's exciting

"I can't think of any field as exciting as the technology field," Gen. Lyles said. "To have the opportunity to understand and perhaps master the sciences, or to be able to shape technology to solve problems and needs is very enriching."

"That's why I try to encourage young people to have an interest in math and sciences. Now, couple that interest into a career like the U.S. Air Force, the preeminent technical service, and the rewards, fun and excitement are almost unbounded."

— Tech Sgt. Carl Norman, AFMC Public Affairs